PATENT ABSTRACTS OF JAPAN

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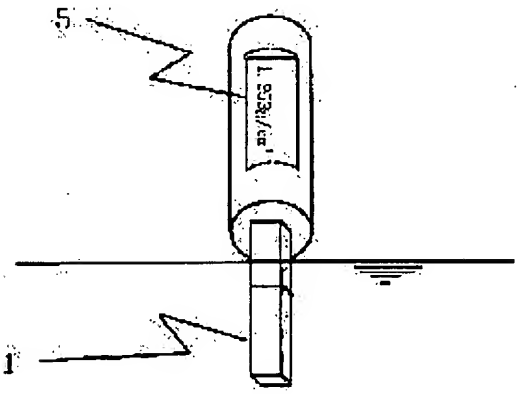
(54) OSCILLATORY DENSITY METER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a density meter utilizing the fact that the frequency of a piezoelectric oscillator self-oscillating in a gas or liquid is varied depending on the density of the gas or liquid.

SOLUTION: Density is measured by oscillating a liquid or gas to be measured and analyzing the response of an oscillator. The oscillator 1 is subjected to free oscillation by a self-excited oscillation circuit 2, the natural frequency thereof is measured by means of a counter 3, and the measurement is converted into a density being measured.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or

application converted registration]

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The density meter which used that the frequency of vibrator changed according to the consistency of the gas or a liquid when the piezoelectric transducer which carries out self-excited vibration was placed into the gas or the liquid.
[Claim 2] The density meter using the impulse response of the placed piezoelectric transducer changing to a gas or a liquid according to the consistency of the gas or a liquid.
[Claim 3] The density meter using the frequency response of the placed piezoelectric transducer changing to a gas or a liquid according to the consistency of the gas or a liquid.
[Claim 4] It is the density meter of any 1 publication among claim 1 characterized by using Xtal as a piezoelectric transducer thru/or claim 3.
[Claim 5] It is the density meter of any 1 publication among claim 1 characterized by using a ceramic vibrator as a piezoelectric transducer thru/or claim 3.
[Claim 6] The density meter of claim 1 characterized by using an electronic counter as an approach of detecting frequency change, or claim 2.
[Claim 7] It is the density meter of any 1 publication among claim 1 characterized by being attached in the function converted into a consistency or concentration from detected frequency change thru/or claim 3.
[Claim 8] It is the multipoint density meter of any 1 publication among claim 1 which can measure density distribution thru/or claim 7 term, using a density meter two or more.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the density meter used for measurement of SS concentration of the deleterious material in concentration management of abrasive grains, such as CMP (chemical mechanical polishing) polish equipment in a semiconductor device production process, and environment management.
[0002]
[Description of the Prior Art] When measuring the consistency of a liquid conventionally, a liquid is sampled and it is carried out by measuring the volume and mass. However, in order to have measured this continuously, it was carrying out by measuring the light in the inside of a liquid, and the magnitude of attenuation of a sound conventionally. Light and the method which calculates a consistency from the magnitude of attenuation of a sound ask for the relation between the magnitude of attenuation and a consistency beforehand for every liquid type which measures a consistency, is with the calibration value, and densitometry is performed. This is because the magnitude of attenuation of light and a sound is not directly related to a consistency.
[0003] For example, when using light, even if it is the same concentration, by the concentration of the white matter, and the concentration of the black matter, it becomes a different attenuation value. Moreover, especially as for the magnitude of attenuation, in the case of the ultrasonic formality meter shown in drawing 5 , the effect of whenever [liquid moderate temperature] appears greatly. Therefore, there is a problem from which a calibration curve differs for every class of measured liquid.
[0004]
[Problem(s) to be Solved by the Invention] This invention was made in order to solve the above-mentioned trouble, and it measures a consistency by completely different principle from the conventional technique. In order to measure mass directly, a means to make the liquid to measure or a gas exercise is required. For example, if vibrator is vibrated underwater, the liquid near the vibrator will vibrate on the frequency of vibrator, and an operation which the mass of vibrator increased will arise. Moreover, liquid also produces the operation which makes an operation of a spring increase.
[0005] For this reason, the resonant frequency of vibrator changes. An operation of this additional mass and an addition spring is influenced by the consistency of a liquid. Therefore, it aims at offering the equipment which measures the consistency of a liquid by measuring the **** vibration frequency of vibrator.
[0006]
[Means for Solving the Problem] The mechanical oscillator densitometer of this invention is a density meter using the frequency of vibrator changing according to the consistency of the gas or a liquid, when the piezoelectric transducer which carries out self-excited vibration is placed into a gas or a liquid.
[0007] Moreover, it is a density meter using the impulse response of the placed piezoelectric transducer changing to a gas or a liquid according to the consistency of the gas or a liquid. It is the density meter characterized by using Xtal or a ceramic vibrator as a piezoelectric transducer. It is the density meter

which carries out the thing description using an electronic counter as an approach of detecting frequency change. It is the density meter characterized by being attached in the function converted into a consistency or concentration from detected frequency change.

[0008]

[Example] In order to measure the resonant frequency of vibrator, it is necessary to carry out proper oscillation of the vibrator using a self-excitation dispatch circuit, and to measure the vibration frequency, or to analyze in quest of an impulse response and a frequency response. If it thinks practical, it will be thought that the former is advantageous. Here, the block diagram of the example in this case is shown in drawing 1 .

[0009] In drawing 1 , a sign 1 is vibrator. Although the product made from a ceramic is used, vibrator 1 can use the product made from Xtal, when temperature insensible nature is required. A sign 2 is a self-excitation dispatch circuit. The example of a circuit of vibrator 1 and the self-excitation dispatch circuit 2 is shown in drawing 2 . A sign 3 is a counter which measures a self-excitation dispatch frequency. A sign 4 is the part changed into a consistency from a self-excitation dispatch frequency, and performs this conversion with a microcomputer. A sign 5 is a consistency display.

[0010] Outline drawing of this example is shown in drawing 3 and drawing 4 . Drawing 3 shows the example which used this invention for the portable mold density meter. This operates by the dry cell. Drawing 4 R> 4 shows the example which used this invention as a density meter sensor. This is used installing in equipment.

[0011]

[Effect of the Invention] When the consistency of a liquid or a gas was measured continuously conventionally, the sound in the liquid or a gas and the magnitude of attenuation of light were measured, and the method of asking for a consistency indirectly was performed. Since this invention is the approach of making a measured liquid or a gas exercise and measuring a consistency, it is direct mensuration. Therefore, manufacture of the density meter which has a more insensible property is attained to the class of a measured liquid or gas.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing one example of the configuration for enforcing the measuring method of the consistency in connection with this invention.
[Drawing 2] In order to make a liquid or a gas generate vibration, it is the circuit diagram showing one example of a self-excitation dispatch circuit for vibrating vibrator.
[Drawing 3] It is the example which used this invention for the portable mold density meter.
[Drawing 4] It is the example which used this invention for the sensor mold density meter.
[Drawing 5] It is the example of representation of the conventional ultrasonic formality meter.
[Description of Notations]
1 Vibrator (Sensor)
2 Self-oscillation Circuit
3 Electronic Counter
4 Frequency Consistency Transducer
5 Consistency Display
6 Ultrasonic Transmitting Section
7 Ultrasonic Receive Section
8 Thermometer
9 Consistency Operation Part, Consistency Display

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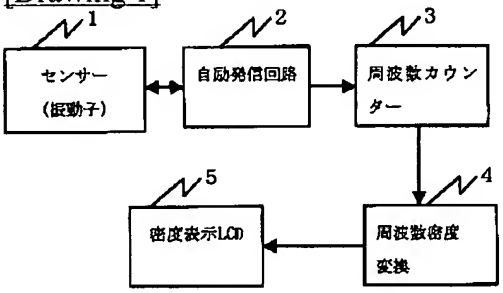
DRAWINGS

[Drawing 1]



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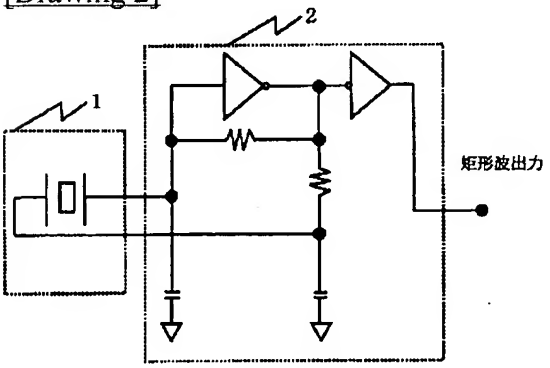
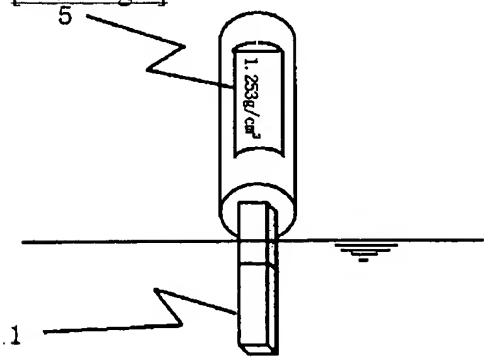
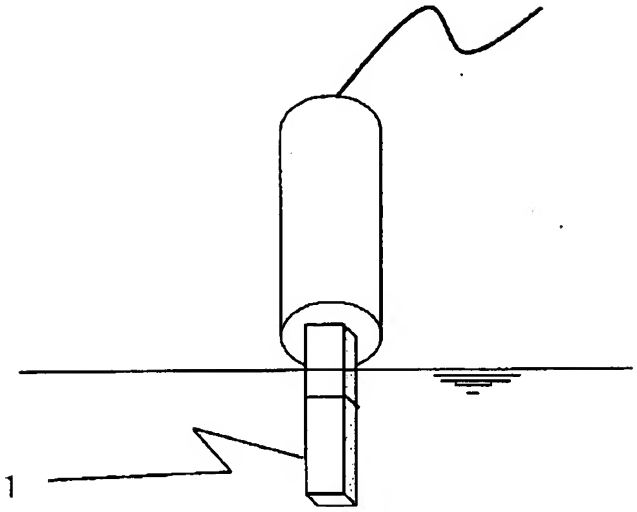


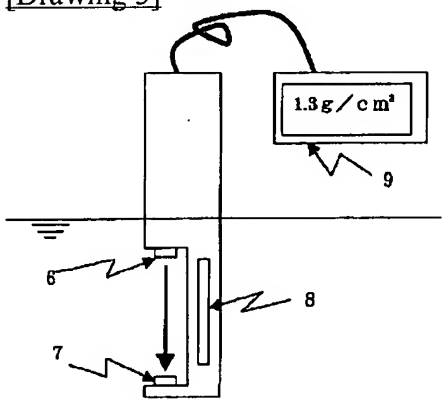
[Drawing 3]



[Drawing 4]



[Drawing 5]



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